Tutorial 1

Assignment 1, lib280, and you!

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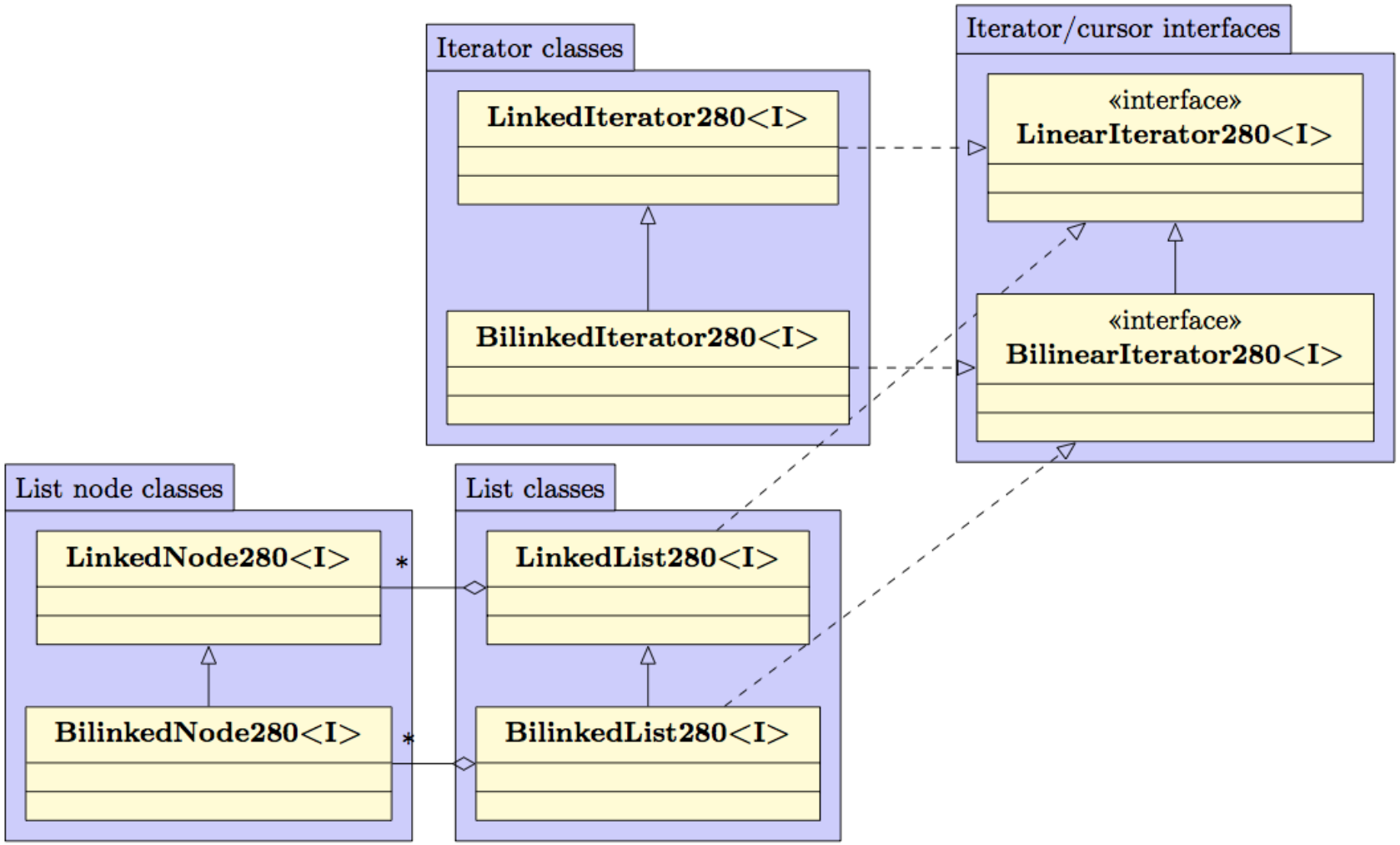
The Plan

1. Introduction to List classes in lib280.
2. Examples
   - How to use a `LinkedList280` and `LinkedIterator280`.
3. Go over Assignment 1 so that everything is clear.
   - Review the tasks to be completed on Assignment 1.
   - Run through the tutorial on importing lib280 into IntelliJ and setting up a project to use it.

Part I

Introduction to List classes in lib280.

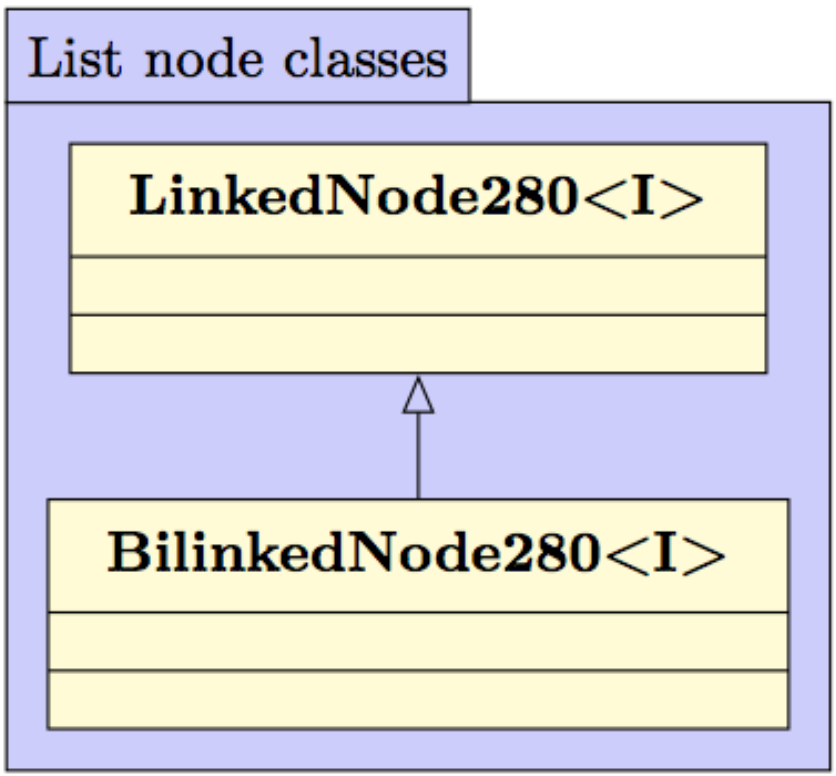
Singly- and Doubly- Linked List Classes in `lib280`



(Remember: here, purple packages are for grouping, not packages.)

Singly- and Doubly- Linked List Classes in `lib280`

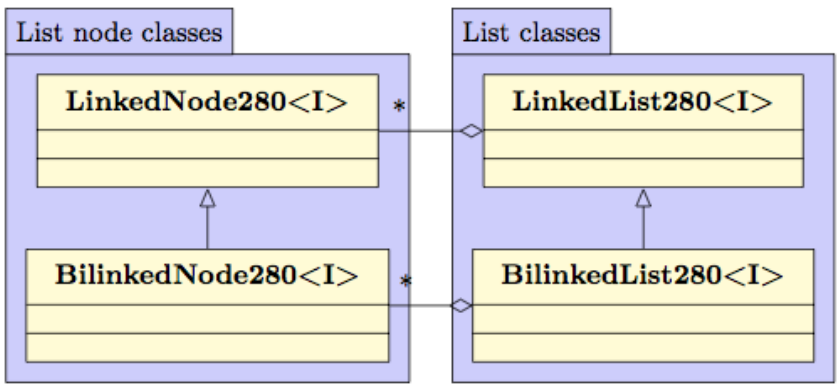
List Nodes



- Each one stores an object from generic class `I`.
- A `BilinkedNode280` is a little bit more than a `LinkedNode280`.
- Includes a previous (`prev`) reference in addition to the `next` node reference in `LinkedNode280`; also accessor and mutator for the `prev` reference.

Singly- and Doubly- Linked List Classes in `lib280`

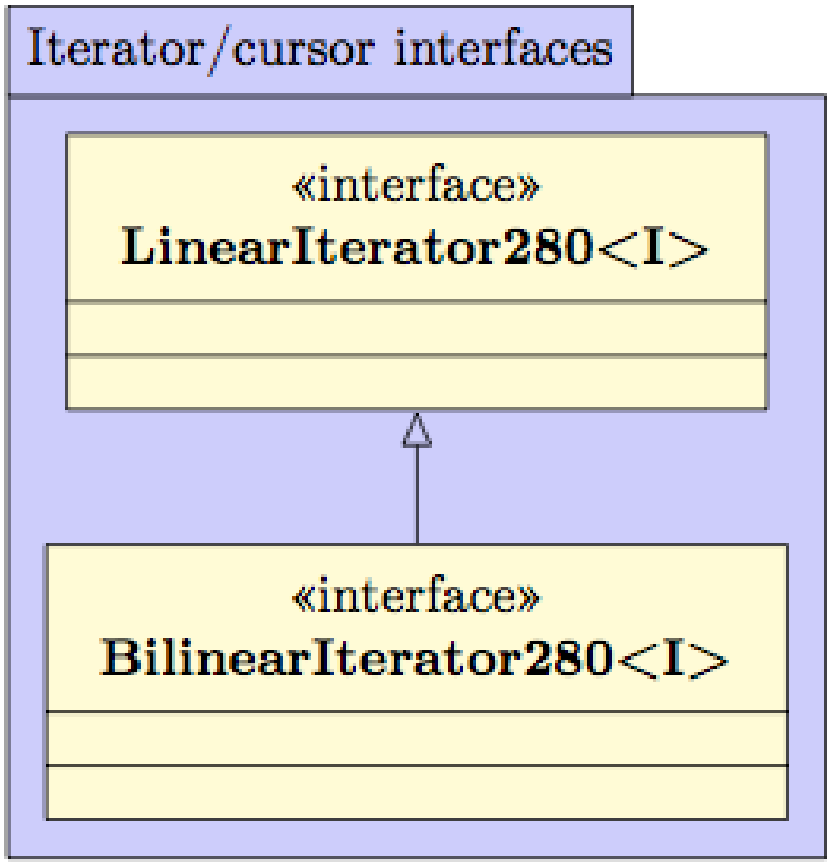
Lists



- Lists are collections of nodes.
- A *BilinkedList280* is a little bit more than a LinkedList. E.g. includes `tail` reference not in `LinkedList280`.
- Some inherited methods must be overridden in *BilinkedList280* to keep track of `tail` and node `prev` pointers.

Singly- and Doubly- Linked List Classes in `lib280`

Iterator/Cursor Interfaces



(Actually in the `lib280.base` package.)

An interface is a specific pattern of behaviour.

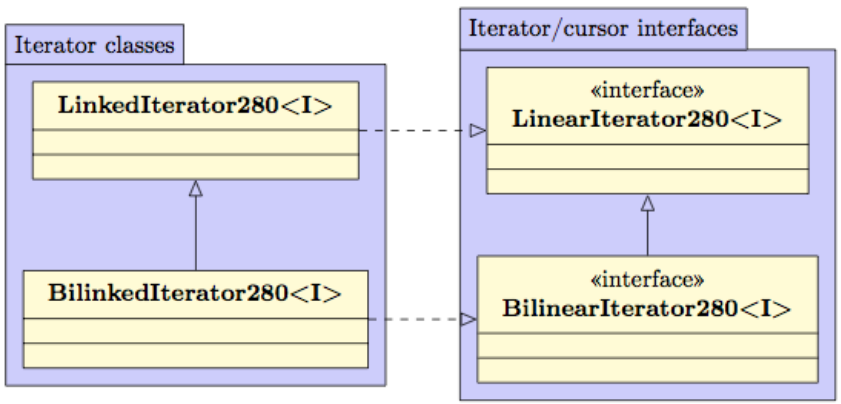
- `boolean before()`
- `void goBefore()`
- `boolean after()`
- `void goAfter()`
- `void goFirst()`
- `void goForth()`
- `I item()`
- `boolean itemExists()`

`BlinearIterator280` adds:

- `void goLast()`
- `void goBack()`

Singly- and Doubly- Linked List Classes in `lib280`

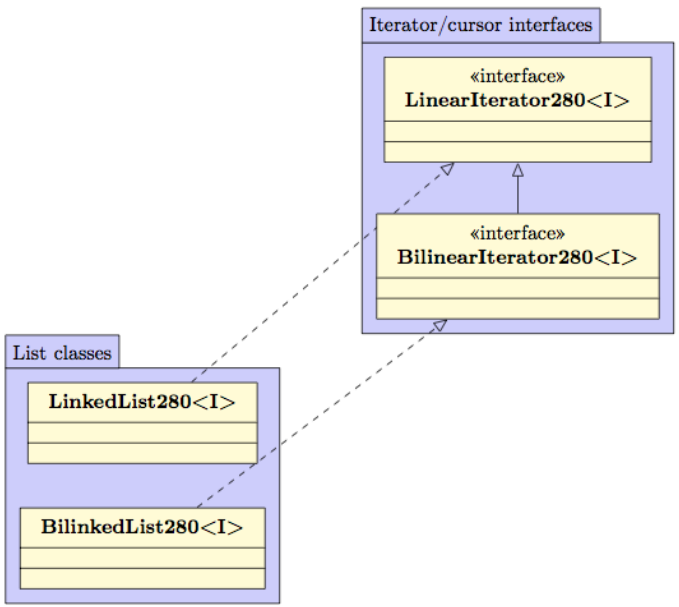
Iterators



- `LinkedIterator280` and `BilinkedIterator280` implement the linear iterator interfaces.

Singly- and Doubly- Linked List Classes in `lib280`

Cursors



The list classes can have cursors by implementing the same linear iterator interfaces.

- `BilinkedList280` directly implements `BilinearIterator280`.
- `LinkedList280` implements `LinearIterator280`

Thus the linked lists in lib280 have both cursors and iterators.

Iterators

Reminder:

Iterators provide the same functionality as a container ADT that has a cursor, but they are separate objects from the container. This allows us to record a cursor position that is different and independent from the position recorded by the container's internal cursor.

Cursors vs. Iterators

Uses of Cursors

- Insert an element `y` immediately before an element `x` already in the list:
  1. `search(x)` to find `x`
  2. `insertBefore(y)` to add `y` right after `x`
- Delete an item from the list:
  1. `search(x)` to find `x` in the list
  2. if `itemExists()` then `deleteItem()` to delete `x`

These tasks use the cursor to do something to the list based on the position of the cursor. The internal representation of position is **abstracted**. The `ArrayedList280` classes uses the same cursor interface, so positions within a list can be manipulated in exactly the same way for both classes, despite the differences in the internal data structure.

Cursors vs. Iterators

Iterators

An iterator is external, for accessing data only indirectly.

- Example uses:
  - Printing out everything in a list
  - Keeping track of multiple positions in a list.
- An iterator is how you go through the elements of a structure.

Cursors vs. Iterators

- If a class exposes the interface to its cursor, then the cursor can be used like an iterator too. This is the case for the linked list classes in lib280. It is therefore important that list methods that might use the cursor in their implementation, but are not supposed to move the cursor from the user's perspective, save and restore its position.
- For example, the `has()` method in `LinkedList280` uses the `search()` method to see if the given element is in the list. The `search()` method moves the cursor. But the `has()` method isn't supposed to cause the cursor to move! So notice how `has()` saves the cursor position using `currentPosition` and then, after using `search()`, restores the original cursor position using `goPosition()`. This avoids the undesirable **side effect** of `has` causing the cursor to move.

Cursors vs. Iterators

- But a class might NOT expose its cursor, for example, a stack. The current position in a stack is always the top element. Stacks do not include public methods to manipulate the cursor position because it should not ever be moved! But one could envision a stack with an iterator that lets you examine the contents of the stack. This would be OK because the internal cursor would not be affected.

Part II

Using the `LinkedList280` Class

Demo: `ListDemo.java`

Let's take a look at `ListDemo.java`

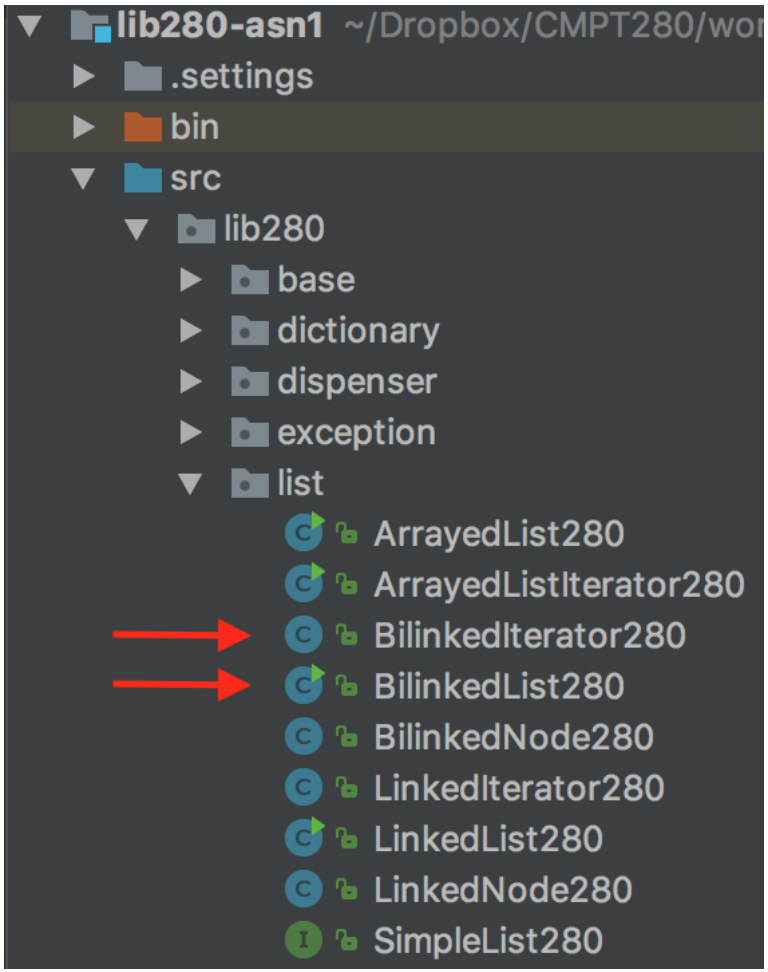
Part III

Assignment 1

Importing `lib280-asn1` Lib280

- Demonstration of how to import lib280 into an IntelliJ project.
- Follow the parts 1 and 2 of the self-guided tutorial from the website.

Navigating `lib280-asn1` Within IntelliJ



- Things look nearly identical in Eclipse.
- Important files for Asn1 are `BilinkedList280.java` and `BilinkedIterator280.java`
- Definitely ignore the other packages for now.
- Be aware of the other classes in `lib280.list` and their relationships to the bi-linked list classes.

Importing `lib280-asn1` Lib280

- Demonstration of how to create a project that references lib280.
- Follow the part 3 of the self-guided tutorial from the website.

The actual questions

Question 1

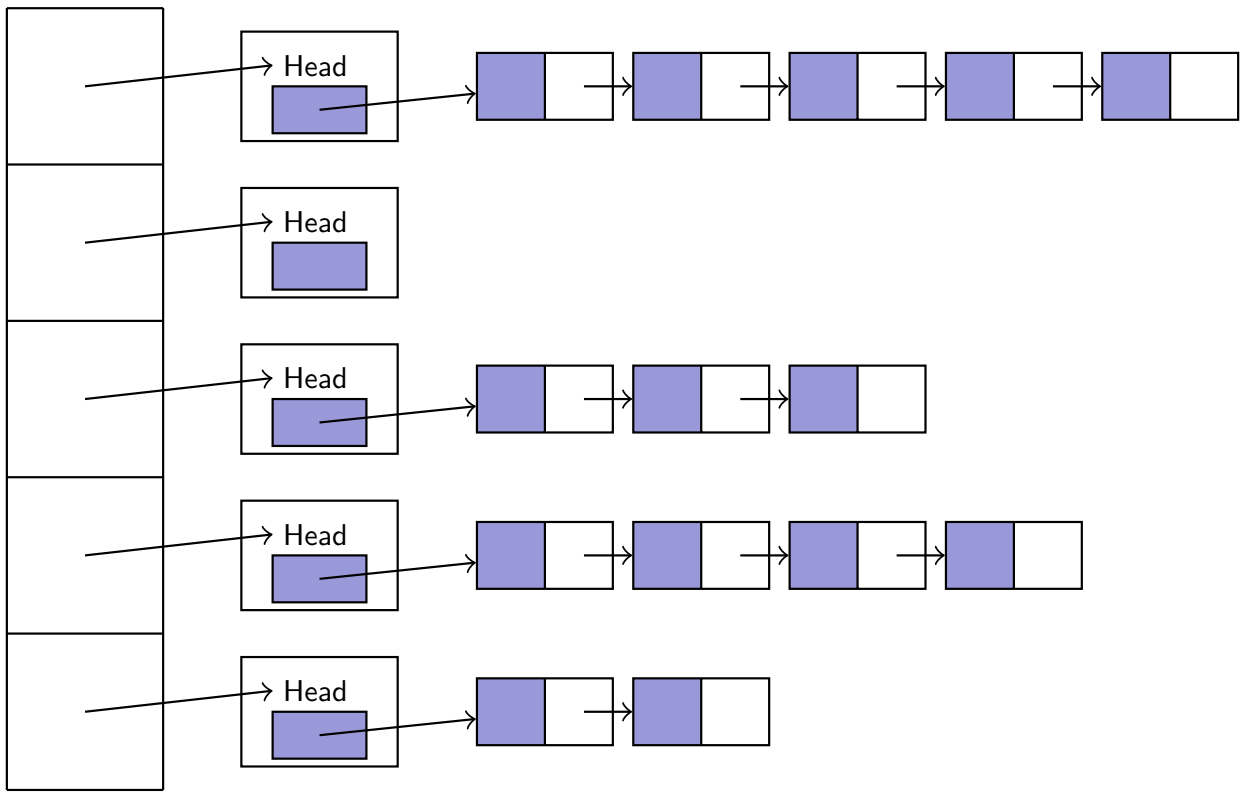
Hints and Reminders;

- The given function `genratePlunder()` is used to create the input data for this program.
- The `Sack.java` class is given. You don't have to write it yourself.
- You only have to write a `main()` program that finds out how much of each type of grain Jack has.

The actual questions

Question 1

In this question you need to make an array of lists, conceptually:



The actual questions

Question 1

In Java, have to cheat a bit to get around limitations of arrays of generic types to create an array of lists of `Sack` instances:

```
1  @SuppressWarnings("unchecked")
2  LinkedList280<Sack> listArray[] = new LinkedList280[size];
3  //            ^^^^^^ Type parameter here!          ^^^ but not here!
```

The `@SuppressWarnings("unchecked")` stops Java from complaining that this is unsafe. It **is** unsafe, but only if you go out of your way.

The actual questions

Question 2

- Fill in the `// TODO`s based on the method headers.
- **ONLY** fill in the `// TODO`s. Do not change other code.
  - (This is both easier and required.)

The actual questions

Question 2

Tips and tricks:

- The javadoc comments are how your javadoc comments should look on future assignments.
  - They are representative in terms of both appearance and quality.
- In general, good javadoc comments mean that IntelliJ will explain code to you.
  - Specifically, they'll explain the `lib280` to you.

The actual questions

Question 3

- Write regression tests for the new methods you wrote.
- Guidelines for writing tests can be found in the Topic 2 lecture notes.

Policy reminder

- Late assignments are not accepted and will get a mark of 0.
- Partial assignments that are handed in on time will receive partial credit.
- You could hand in tests for question 3, but no implementations on question 2 and still get points for how good the tests are. Black-box testing only requires that you know the interface, which you are given!